AIR-SPARGED HYDROCYCLONE TECHNOLOGY

A Research Effort of the United States Air Force Research Laboratory
Tyndall Air Force Base, Florida

THE PROBLEM

Air Force activities generate wastewater containing suspended solids; petroleum, oil, and lubricant (POL) products; emulsion stabilizing agents; and Aqueous Film Forming Foam (AFFF) liquids. Such contaminants can interfere with the operations of industrial wastewater treatment plants or can generate an effluent stream, which could be out of compliance with local discharge limits. Both conditions generated Environment, Safety and Occupational Health Needs.

Wastewaters containing AFFF must be pretreated before being released to federally or privately owned treatment works due to persistent foaming and high biochemical oxygen demand. Conventional wastewater pretreatment processes are either ineffective or too costly to treat emulsified oils caused by soaps, detergents and AFFF releases. Gravity oil/water separators (OWS) cannot separate chemically stabilized O/W emulsions leaving aircraft and vehicle wash racks. Separators incorporating coalescing media provide only a marginal improvement in separation efficiency.

Other pretreatment unit operations, such as thermal treatment, chemical demulsification, depth filtration and combinations of these, are capital intensive and usually have very high operation and maintenance costs.

THE OBJECTIVE

The US Air Force pursued a Small Business Innovative Research (SBIR) contract with Advanced Processing Technologies Inc. (APT) that was managed by the Air Force Research Laboratory (AFRL/MLQ). This contract lead to the development of Air-Sparged Hydrocyclone (ASH) technology. An ASH reactor can remove any hydrophobic particle in an aqueous waste stream. Including emulsified POL products. AFFF is removed by adsorption to hydrophobic particles. This technology can remove 80-100 percent of these contaminants from vehicle maintenance sumps, vehicle and aircraft wash racks, jet engine test cell drains and fire fighting training pit waste streams.

ASH technology is a low-cost, but highly efficient treatment option for emulsified oil and AFFF waste streams. By combining chemical coagulation, hydrocyclone, and air flotation principles into one unit operation, an ASH unit can provide adequate pretreatment, and often final treatment, of these effluents. It has a very large throughput while maintaining a small footprint. ASH technology also provides operational flexibility as a fixed process to provide continuous or batch treatment or as a small, standard sized trailer to treat geographically separated sources.

THE APPROACH

Air-Sparged Hydrocyclone (ASH) technology is an emerging technology/equipment developed by Advanced Processing Technologies, Inc. (APT) for different environmental applications. The equipment can be used for removal and concentration of heavy metals from soil, water or other media; removal of oil and oily substances from different wastewaters; VOC stripping from water/sludge, and other applications. It offers a high processing capacity combined with a high removal efficiency, resulting in low capital investment and operation costs, as well as mobility for easy and quick on-site services with trailer mounted compact mobile systems.

BENEFITS

The benefit to DoD as a whole is tremendous. Currently, all DoD facility bases have inoperable or ineffective OWS's due to poor maintenance or user process changes. These separators are, essentially, holding pits that must be periodically pumped out. This constitutes hazardous waste that has to be disposed of at great expense. Most military facilities, and the DoD firefighting school (used by the Army, Air Force and Marine Corps) have fire pits where AFFF is used for training, creating hazardous waste that cannot be sent to the IWTP.

***Annual Savings/Pay Back*:** Capital expenditures for an ASH system depend on the flow rate to be treated. Operations and maintenance costs are based on the contaminant loading of the waste stream. After seven on-site tests, the calculated operational cost of the ASH system is $0.40-$1.10 per 1000 gallons of water processed.

Untreated Waste ***ASH Treated Waste***

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ASH97-080599